

Reduction in Dynamic Visual Acuity Reveals Gaze Control Changes following Spaceflight

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INTRODUCTION

Exposure to microgravity causes adaptive changes in eye-head coordination that can lead to altered gaze control. This could affect postflight visual acuity during head and body motion. The goal of this study was to characterize changes in dynamic visual acuity after long-duration spaceflight.

METHODS

Dynamic Visual Acuity (DVA) data from 14 astro/cosmonauts were collected after long-duration (~6 months) spaceflight. The difference in acuity between seated and walking conditions provided a metric of change in the subjects' ability to maintain gaze fixation during self-motion. In each condition, a psychophysical threshold detection algorithm was used to display Landolt ring optotypes at a size that was near each subject's acuity threshold. Verbal responses regarding the orientation of the gap were recorded as the optotypes appeared sequentially on a computer display 4 meters away. During the walking trials, subjects walked at 6.4 km/h on a motorized treadmill.

RESULTS

A decrement in mean postflight DVA was found, with mean values returning to baseline within 1 week. The population mean showed a consistent improvement in DVA performance, but it was accompanied by high variability. A closer examination of the individual subject's recovery curves revealed that many did not follow a pattern of continuous improvement with each passing day. When adjusted on the basis of previous long-duration flight experience, the population mean shows a "bounce" in the re-adaptation curve.

CONCLUSION

Gaze control during self-motion is altered following long-duration spaceflight and changes in postflight DVA performance indicate that vestibular re-adaptation may be more complex than a gradual return to normal.